

8-5 Study Guide and Intervention

Using the Distributive Property

Use the Distributive Property to Factor The Distributive Property has been used to multiply a polynomial by a monomial. It can also be used to express a polynomial in factored form. Compare the two columns in the table below.

Multiplying	Factoring
$3(a + b) = 3a + 3b$	$3a + 3b = 3(a + b)$
$x(y - z) = xy - xz$	$xy - xz = x(y - z)$
$6y(2x + 1) = 6y(2x) + 6y(1)$ $= 12xy + 6y$	$12xy + 6y = 6y(2x) + 6y(1)$ $= 6y(2x + 1)$

Example 1 Use the Distributive Property to factor $12mp + 80m^2$.

Find the GCF of $12mp$ and $80m^2$.

$$12mp = 2 \cdot 2 \cdot 3 \cdot m \cdot p$$

$$80m^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot m \cdot m$$

$$\text{GCF} = 2 \cdot 2 \cdot m \text{ or } 4m$$

Write each term as the product of the GCF and its remaining factors.

$$\begin{aligned} 12mp + 80m^2 &= 4m(3 \cdot p) + 4m(2 \cdot 2 \cdot 5 \cdot m) \\ &= 4m(3p) + 4m(20m) \\ &= 4m(3p + 20m) \end{aligned}$$

$$\text{Thus } 12mp + 80m^2 = 4m(3p + 20m).$$

Example 2 Factor

$6ax + 3ay + 2bx + by$ by grouping.

$$\begin{aligned} 6ax + 3ay + 2bx + by & \\ &= (6ax + 3ay) + (2bx + by) \\ &= 3a(2x + y) + b(2x + y) \\ &= (3a + b)(2x + y) \end{aligned}$$

Check using the FOIL method.

$$\begin{aligned} (3a + b)(2x + y) & \\ &= 3a(2x) + (3a)(y) + (b)(2x) + (b)(y) \\ &= 6ax + 3ay + 2bx + by \checkmark \end{aligned}$$

Exercises

Factor each polynomial.

- $24x + 48y$
 $24(x + 2y)$
- $30mp^2 + m^2p - 6p$
 $p(30mp + m^2 - 6)$
- $q^4 - 18q^3 + 22q$
 $q(q^3 - 18q^2 + 22)$
- $9x^2 - 3x$
 $3x(3x - 1)$
- $4m + 6p - 8mp$
 $2(2m + 3p - 4mp)$
- $45r^3 - 15r^2$
 $15r^2(3r - 1)$
- $14t^3 - 42t^5 - 49t^4$
 $7t^3(2 - 6t^2 - 7t)$
- $55p^2 - 11p^4 + 44p^5$
 $11p^2(5 - p^2 + 4p^3)$
- $14y^3 - 28y^2 + y$
 $y(14y^2 - 28y + 1)$
- $4x + 12x^2 + 16x^3$
 $4x(1 + 3x + 4x^2)$
- $4a^2b + 28ab^2 + 7ab$
 $ab(4a + 28b + 7)$
- $6y + 12x - 8z$
 $2(3y + 6x - 4z)$
- $x^2 + 2x + x + 2$
 $(x + 1)(x + 2)$
- $4m^2 + 4mp + 3mp + 3p^2$
 $(4m + 3p)(m + p)$
- $12ax + 3xz + 4ay + yz$
 $(3x + y)(4a + z)$
- $12a^2 + 3a - 8a - 2$
 $(4a + 1)(3a - 2)$
- $xa + ya + x + y$
 $(x + y)(a + 1)$

8-5 Study Guide and Intervention *(continued)***Using the Distributive Property**

Solve Equations by Factoring The following property, along with factoring, can be used to solve certain equations.

Zero Product Property

For any real numbers a and b , if $ab = 0$, then either $a = 0$, $b = 0$, or both a and b equal 0.

Example Solve $9x^2 + x = 0$. Then check the solutions.

Write the equation so that it is of the form $ab = 0$.

$$9x^2 + x = 0$$

Original equation

$$x(9x + 1) = 0$$

Factor the GCF of $9x^2 + x$, which is x .

$$x = 0 \text{ or } 9x + 1 = 0$$

Zero Product Property

$$x = 0 \quad x = -\frac{1}{9}$$

Solve each equation.

The solution set is $\left\{0, -\frac{1}{9}\right\}$.

Check Substitute 0 and $-\frac{1}{9}$ for x in the original equation.

$$9x^2 + x = 0$$

$$9x^2 + x = 0$$

$$9(0)^2 + 0 \stackrel{?}{=} 0$$

$$9\left(-\frac{1}{9}\right)^2 + \left(-\frac{1}{9}\right) \stackrel{?}{=} 0$$

$$0 = 0 \checkmark$$

$$\frac{1}{9} + \left(-\frac{1}{9}\right) \stackrel{?}{=} 0$$

$$0 = 0 \checkmark$$

Exercises

Solve each equation. Check your solutions.

1. $x(x + 3) = 0$

$$\{0, -3\}$$

2. $3m(m - 4) = 0$

$$\{0, 4\}$$

3. $(r - 3)(r + 2) = 0$

$$\{-2, 3\}$$

4. $3x(2x - 1) = 0$

$$\left\{0, \frac{1}{2}\right\}$$

5. $(4m + 8)(m - 3) = 0$

$$\{-2, 3\}$$

6. $5t^2 = 25t$

$$\{0, 5\}$$

7. $(4c + 2)(2c - 7) = 0$

$$\left\{-\frac{1}{2}, \frac{7}{2}\right\}$$

8. $5p - 15p^2 = 0$

$$\left\{0, \frac{1}{3}\right\}$$

9. $4y^2 = 28y$

$$\{0, 7\}$$

10. $12x^2 = -6x$

$$\left\{-\frac{1}{2}, 0\right\}$$

11. $(4a + 3)(8a + 7) = 0$

$$\left\{-\frac{7}{8}, -\frac{3}{4}\right\}$$

12. $8y = 12y^2$

$$\left\{0, \frac{2}{3}\right\}$$

13. $x^2 = -2x$

$$\{-2, 0\}$$

14. $(6y - 4)(y + 3) = 0$

$$\left\{-3, \frac{2}{3}\right\}$$

15. $4m^2 = 4m$

$$\{0, 1\}$$

16. $12x = 3x^2$

$$\{0, 4\}$$

17. $12a^2 = -3a$

$$\left\{-\frac{1}{4}, 0\right\}$$

18. $(12a + 4)(3a - 1) = 0$

$$\left\{-\frac{1}{3}, \frac{1}{3}\right\}$$